Bridging the gap between weather and climate

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Andrew Robertson is a Senior Research Scientist and head of the Climate Group at Columbia University's International Research Institute for Climate and Society (IRI). He works on seasonal and sub-seasonal forecasts, with the goal of making these forecasts usable by decision-makers in areas such as agriculture and food security, water resource management, and disaster risk reduction.

Robertson received funding from the Center for Climate and Life to create a real-time forecasting system that can predict sub-seasonal weather and climate fluctuations for the time period of about a week to a month ahead; the forecast will be issued each week in a probability format relevant to the risk of floods, droughts, heat and cold waves, and other societal impacts. Being able to forecast this range will provide essential early warnings that can help societies adapt to and become more resilient to the effects of climate change.

Q. What is the problem you're trying to solve?

A. The IRI grew out of breakthroughs in El Niño and climate science forecasting, and we harnessed those for societal use by making seasonal forecasts and issuing these every month and in a way that helps people with decision-making: if they should do something different in terms of their planting strategies for a particular crop, for example.

One thing we quickly realized is that people care about other timescales

too. When we make seasonal climate forecasts they're typically for an average of how the upcoming season might turn out. But in terms of what actually makes an impact on people, it's the weather—can we say what the weather within the climate looks like?

So this Center for Climate and Life project is about expanding forecasts so we're able to make weekly, sub-seasonal forecasts. This project really came out of my work with the Sub-seasonal to Seasonal Prediction Project (S2S), which is coordinated jointly by the World Climate Research Programme (WCRP) and the World Weather Research Programme (WWRP). The idea is for the two communities to work together on addressing this gap between the weather forecast and the seasonal climate forecast, and to improve the forecast skill in that range and make forecasts that are useful to different stakeholders.

I'm one of the co-chairs of S2S, so in the last few years, I've been working a lot on the sub-seasonal timescale. I thought it would be great—because we've been doing this work with the seasonal climate forecasting at IRI and realizing what's useful to people in their decisions is not just seasonal climate—if we could make a real-time system, just like the one we make for seasonal forecasts but for the sub-seasonal range, for several weeks ahead. This could really bring together this interest in the world climate and weather research communities with the kind of applications-oriented work that's done by the IRI.

This project could be transformational in many ways. A buzzword that's used in this context is "seamless forecasting." Now you have weather forecasts out to a week or ten days or so and then you have your seasonal forecast for upcoming months. While we may not be able to say so much on each individual time range, if we can make the forecasting seamless, going from days to seasons, and if that could be factored into people's use, it would be tremendous.

Q. What do you find most exciting about this type of work?

A. This project is exciting because it's a new forecasting time range. Before, people thought this range of 15 days to a season was a "predictability desert"—difficult to forecast. What's changed is that our understanding and ability to predict of some of the phenomena and climate drivers, such as the Madden–Julian Oscillation, in this range has gotten much better, so we now have a scientific basis for making forecasts in this range.

I also find the opportunity to expand the work that we do at the IRI exciting. This time range is of a lot of interest to different stakeholders. I hear from people at the Red Cross Climate Centre, for example, that in the humanitarian aid community, a critical lead-time is about a month—it takes them that long to position supplies and such when responding to some kind of disaster or event. So if they have a heads up about a likely or pending high-impact weather-related hazard several weeks beforehand, they can better prepare.

And, for example, in agriculture, you could use these forecasts for tactical management decisions. If you had a forecast for two to four weeks ahead that had some skill in that range, it could be used for irrigation scheduling, or fertilizer and pesticide applications. Or in the energy sector—you would have a heads up about upcoming cold spells or heat waves that might really impact electricity demand. Also in water for reservoir management—they need to know when to release water from reservoirs and so on. There's a lot that could be done if we could develop skillful forecasts in this sub-seasonal time range and I find that very exciting.

Q. How might this work advance understanding of

the challenges posed by climate change?

A. We talk a lot about building resiliency to climate and weather shocks. If people are resilient through the use of skillful forecasts then they will be less vulnerable to the vagaries of weather and climate, and they can adapt better to climate change. By building resiliency through forecasting on shorter ranges from weather to seasonal, we can really help people to become better adapted to climate in general—and within a changing climate that becomes even more important.

But there's still a lot of work to do. We don't know when and where we can really make a forecast that has any value. I might make it sound like it's a sort of straightforward thing to apply things we've done at the seasonal range to this sub-seasonal range, but it's still very much a research domain. But if we come up with this system and it has some skill, it could be of a lot of use and benefit to people.

Q. What gives you hope?

A. I find hope in the number of breakthroughs that have really improved our understanding of the way that the climate system works over the last century. We've managed to make models that can actually simulate the weather and climate and we can forecast the weather many days in advance, which a century ago would have seemed completely incredible. Also in our simulations and projections of climate change, we've made huge advances, so my hope is that we can capitalize on what's known from science about weather and climate to help us deal with climate change, both to adapt to it and also be able to mitigate through emissions controls.

Q. What's your favorite climate read?

A. One website I enjoy and always scan and look at from the point of view of my students is the American Meteorological Society's News You Can Use. They have a nice compendium of stories on recent weather events and climate change.

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